**Scanning electron microscopy cathodoluminescence of vein quartz from the Red Hills porphyry Mo-Cu deposit, west Texas**

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The Red Hills porphyry Mo-Cu deposit is hosted within a calc-alkaline igneous complex consisting of quartz monzonite porphyry (QMP), quartz latite porphyry (QLP), latite porphyry (LP), and biotite porphyry (BP) which have intruded Permian sandstones, siltstones, and dolostones resulting in an extensive hornfels zone with local garnet skarn. U-Pb ages of zircon from the QMP and BP yielded 62.54 ± 0.49 Ma and 66.08 ± 0.31 Ma ages, respectively, which suggest the Red Hills experienced multiple injections of intermediate magmas. Potassic alteration is most prevalent in deep BP dike intercepts, whereas significant overprinting by phyllic alteration has masked the higher temperature alteration in the QMP, QLP, and LP. Biotite-stable assemblages in the QMP occur proximal with the contact of the BP. Chlorite-epidote propylitic alteration occurs above and lateral to the phyllic alteration zone which extends extensively east of the deposit. Destruction of pyrite by highly acidic fluids formed hematite-goethite-jarosite leached cap and supergene alunite and alunite-kaolinite veins. A weak chalcolite blanket is developed in intrusive rocks, but local high grade (>10% Cu) chalcocite intercepts are present in pyritic hornfels.

The Red Hills hypogene veining include gently dipping to randomly oriented, discontinuous A-type barren quartz veins cut by sinuous, high to moderate angled A-type quartz-molybdenite (qz-mo) veins. The barren quartz veins are locally truncated by the QMP suggesting high temperature veining occurred before the emplacement of QMP. Sheeted and planar B-type quartz-molybdenite-pyrite (qz-mo-py) veins formed after the A-type veins and were followed by D-type quartz-sericite-pyrite (QSP) veins. Younger pyrite-chalcopyrite-quartz A-type veins cut early qz-mo veins. Aside from the high temperature barren quartz veins, all vein types fracture all known igneous phases. The chronology of the chalcopyrite-bearing and molybdenite-bearing veins are out of sequence compared to the typical veining styles of both porphyry Cu and porphyry Mo systems.

Scanning electron microscope–cathodoluminescence (SEM-CL) textures of quartz-bearing veins have revealed the relationships and chronologic sequence between vein styles as the P-T conditions and hydrothermal fluid composition evolved. High temperature A-type qz-mo veins reveal first generation molybdenite precipitated in vug filling dark CL quartz, perhaps after dissolution of early quartz as consequence of pressure drop causing quartz solubility. B-type qz-mo-py veins reveal thin, oscillatory zoning of inward oriented quartz crystals precipitated into open space. A
later fracture event along the older quartz vein margins formed euhedral, inward oriented finer grained quartz crystals which define the major episode of molybdenite precipitation. Sphalerite, barite, calcite, anhydrite, and silver-bearing phases were deposited relatively late in the system within the interstices of B-type qz-mo-py veins. Vein quartz textures in phyllic alteration zones display greater complexity in crystal growth. Five episodes of quartz precipitation have been identified in which concentric growth zones commonly follow the shape of embayments caused by dissolution of the earlier quartz-forming event. Thus, SEM-CL has revealed multiple molybdenite and quartz precipitation events which will guide trace element and fluid inclusion studies to constrain the evolution of the hydrothermal fluids that formed the Red Hills deposit.